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Policy Analysis of Emissions Cap and Trade: The United State and The European Union

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POLICY ANALYSIS OF EMISSIONS CAP AND TRADE: THE UNITED STATES AND THE EUROPEAN UNION

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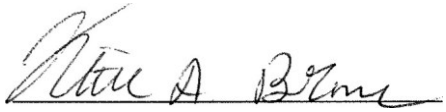

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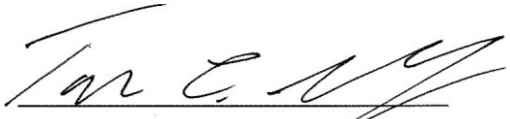

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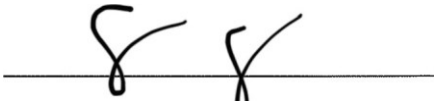

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ABSTRACT

Effects of climate change are appearing each day therefore proactive steps need to be made to reduce these effects. The National Aeronautics and Space Administration (NASA) notes that humans producing greenhouse gases (GHGs) such as carbon dioxide (CO_2), methane, and nitrous oxide are the main reason the Earth's overall temperature is rising (NASA 2019). A policy analysis was done on the European Union Emissions Trading Scheme (EU ETS) along with comparisons to the United States' emissions policies that are in place currently. The European Union (E.U.) itself is both an economic and political union of 27 countries in the continent of Europe (European Union 2019). The goal of this research was to analyze what aspects of emission trading programs worked well, and where future implementations can be upgraded. This study provided suggestions for a nationwide policy to be created for the U.S. Analysis of the EU ETS was done via the EU ETS Handbook provided by the E.U.'s public website. Analysis of both the California Cap and Trade Program (CCTP) and the Regional Greenhouse Gas Initiative (RGGI) were done via the Center for Climate and Energy Solutions policy hub. The study provided evidence that a nationwide emission cap and trade program would be both feasible and economically beneficial to the United States (U.S.). The two emission trading programs currently in effect in the U.S. do not cover aircraft emissions. The proposed nationwide emission program could target aircraft and become just the second country to enforce a policy which limits aircraft emissions.

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INTRODUCTION

Carbon dioxide (CO_2) and other greenhouse gas (GHG) emissions are contributing to climate change. Climate change has many different impacts, but the main areas that are impacted most by climate change are water, food, health, and the environment (National Oceanic and Atmospheric Administration (NOAA) 2019). Areas like the western United States (U.S.) are experiencing droughts due to the lack of snow melt water from Alaska and the Rocky Mountains (NOAA 2019). Food and agriculture in general are also adversely affected by climate change due to changes in weather events, temperature changes, and water availability (NOAA 2019). These climate changes present increased challenges to farmers around the world and can affect the harvest numbers of various crops (NOAA 2019). Human health is also at the precipice of climate change due to increased heat stress cases, waterborne diseases, decreasing air quality, and extreme weather events (NOAA 2019). Finally, the environment itself is being adversely affected by climate change in ways like habitat modification, ocean acidification, and sea level rising (NOAA 2019).

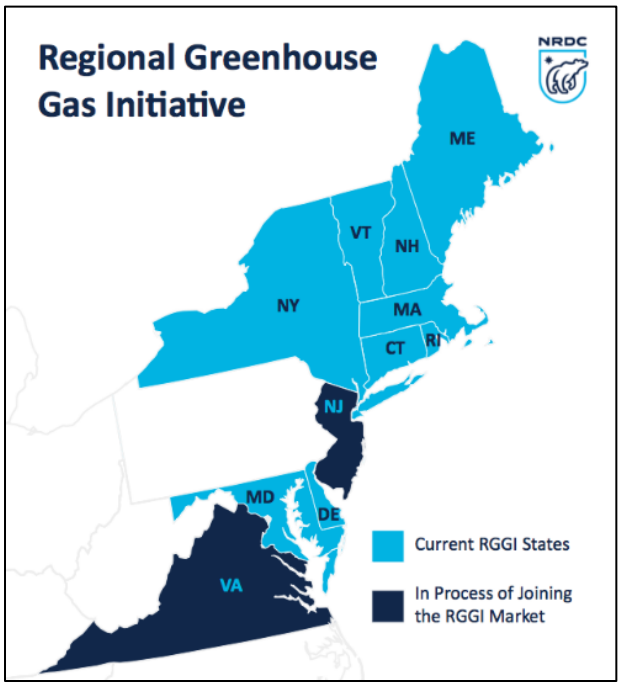
The Intergovernmental Panel on Climate Change (IPCC) which is a panel of 1,300 independent scientists from many different countries have concluded that there is a more than 95 percent probability that human-based activities over the past 50 years have caused warming of Earth (IPCC 2019). Industrial and transportation emissions are said to be the main source of increased CO_2 in our atmosphere by this study (IPCC 2019). These increased levels of CO_2 are now around 414 parts per million, a significant increase from 280 parts per millions only 150 years ago (IPCC 2019). While 150 years may seem like a significant amount of time, with Earth being over 4.6 billion years old, this is extremely recent in comparison (IPCC 2019).

Furthermore, the Industrial Revolution that occurred around 150 years ago coincides with the yearly rise in CO_2 emissions that have been identified by the IPCC (IPCC 2019).

The crisis of climate change has spurred countries to take action to limit their emissions and contributions of GHGs to the atmosphere. One of the most common solutions to this crisis are cap and trade programs for emissions. A cap-and-trade program involves "capping" an industry's emissions and setting penalties for going over that cap. The "trade" aspect allows the companies to buy and sell the allowances given to them. This allows companies to save money by choosing to reduce their emissions rather than purchasing more allowances (Environmental Defense Fund 2017).

This study was a policy analysis of the European Union Emissions Trading Scheme (EU ETS), the California Cap and Trade Program (CCTP), and the Regional Greenhouse Gas Initiative (RGGI) with the goal to create suggestions for a similar policy to be implemented for the entirety of the U.S. With this information, analysis could be done to reveal where the EU ETS and other programs succeed at limiting emissions, and where future programs may need more research or planning. The RGGI spans nine states in the Northeastern corner of the U.S. (Figure 1) (Center for Climate and Energy Solutions 2019). The CCTP affects the state of California only (see Figure 2). The physical area of the European Union (E.U.) spans 27 countries on the continent of Europe (Figure 3)

What states participate in the RGGI (Figure 1) https://www.nrdc.org/resources/regional-greenhouse-gas-initiative-model-nation



(European Union 2019). The hypothesis for this study was that the EU ETS and other similar policies do benefit the country of origin and are a useful resource to base regulations of a future nationwide policy for the U.S.

The state of California (Figure 2) https://www.nationsonline.org/oneworld/map/USA/california_map.htm

Aircraft emissions accounted for three percent of the United States' total CO_2 emissions in 2016 and the U.S. is also responsible for nearly half of aircraft emissions worldwide (Center for Biological Diversity 2016). This data showed that aircraft emissions in the U.S. are related to the issue of climate change and that regulation on aircraft should be implemented. With the U.S. being responsible for such a large portion of global aircraft emissions, implementation of a policy that targets these emissions should be paramount to the actions of easing climate change. New policies are being worked on frequently that target the United States' emissions and the country's impact to climate change. One of these policies that is growing in popularity is the Green New Deal. This policy along with others that attempt to reduce the United States' emissions will become more important as the threat of climate change will only continue to increase.

What countries make up the E.U. (Figure 3)
http://publications.europa.eu/webpub/com/eu-what-it-is/en/

LITERATURE REVIEW

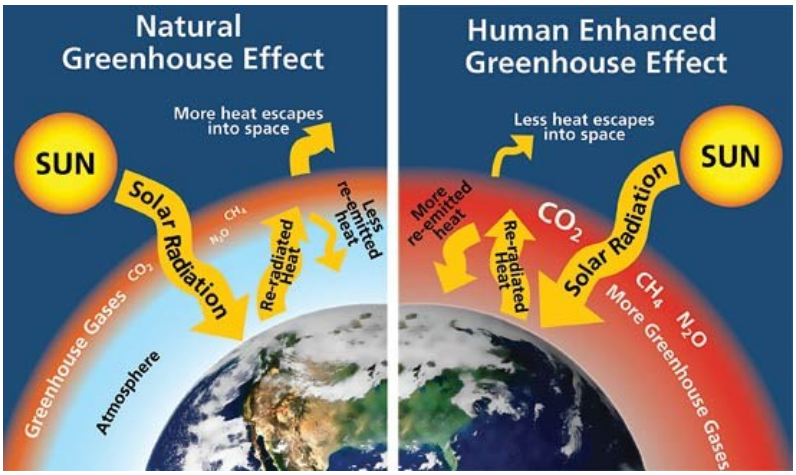
European Union Emission Trading Scheme

The European Commission's Handbook on the EU ETS provides an in-depth look at the history, successes, and future for the EU ETS. This policy became enacted in 2005 and was the first and largest emission trading scheme for reducing greenhouse gas emissions. The decision to enact an emission trading scheme rather than a tax for emissions was made due to the fear that a tax may not lower emissions. This decision to pursue a trading scheme was noted to have a low cost to participants and less strain on the economy of the E.U. Efficient energy investment stimulation was another key component to retaining economic strength in the E.U. The EU ETS was updated in 2009 to incorporate aircraft emissions and further the European Union's desire to move toward renewable energy sources. The EU ETS is not without faults though, but plans are in place to address and solve some of these issues. The main issue that has been highly criticized is the over-allocation of emission allowances (European Commission 2015). This has caused a significant delay in the lowering of emissions in the E.U. because allowances widely available for purchase by any entity. The E.U. has implemented a stringent cap decrease to assist in lowering the numbers of allowances in the E.U. for emissions (European Commission 2015).

What Are Emissions and Which Ones Are Covered by the EU ETS?

While emissions can include many different gasses and other particles, the EU ETS and similar policies shift their focus to carbon dioxide (CO_2). Other gasses such as methane, carbon monoxide, and chlorofluorocarbons are covered in the EU ETS as well (European Commission 2015). The CO_2 emission source is important when analyzing the EU ETS because the main emitters that are covered by this policy are power production entities. Vehicles also fall under

EU ETS policy as aircraft now must comply with a standard emissions cap for operating in E.U. countries (European Commission 2015). Carbon dioxide is important to these policies because of the impact this gas has on Earth's atmosphere and environment. Carbon dioxide is a greenhouse gas, which means that this gas both absorbs and radiates heat (Lindsey 2020). The sun acts to warm the earth's surface and when this occurs, infrared heat is emitted into the atmosphere (Lindsey 2020). Greenhouse gases in the atmosphere then absorb this infrared heat and reflect the heat back towards the earth's surface (Lindsey 2020) (see Figure 4). This phenomenon is compounded when more CO_2 exists in the atmosphere, thus, causing more heat to be reflected towards Earth's surface and causing a slow increase in temperatures (Lindsey 2020). For this reason, CO_2 has been deemed a hazard to the global climate and is the reason why the EU ETS is prioritizing this gas emission over all others (European Commission 2015).



Greenhouse Effect (Figure 4) https://climatechange.lta.org/get-started/learn/co2-methane-greenhouse-effect/

How Increased CO_2 Levels Affect the Earth

As previously mentioned, CO_2 causes increases in global temperatures due to its greenhouse effect. This warming has other implications other than simply causing increased temperatures on average. Carbon dioxide plays a significant role in Earth's oceans and their acidity (Lindsey 2020). CO_2 works to lower pH levels in the ocean therefore making them more acidic. Increases in ocean acidity make the absorption of calcium by marine life for their shells

and skeletons more difficult (Lindsey 2020). The Intergovernmental Panel on Climate Change (IPCC) in 2019 also concluded that rising levels of CO_2 are either directly or indirectly responsible for increased drought length and severity, melting of sea ice on both poles, shrinkage of tundra-type climates, and much more climate change topics.

How Cap and Trade Works

A cap-and-trade program involves "capping" an industry's emissions and setting penalties for going over that cap. The "trade" aspect allows the companies to buy and sell the allowances given to them. This allows companies to save money by choosing to reduce their emissions rather than purchasing more allowances (Environmental Defense Fund 2017). In the E.U., this system goes a step further by providing tax revenue for countries. The sales of allowances provide funds to put back into the economy or fund more renewable resource programs. Other safeguards have been implemented by the E.U. to prevent "outsourcing" of emissions to countries that are just outside the E.U.'s borders. The main safeguard is providing free allowances to low-income nations of the E.U. to help ease the cost of emissions for countries that may still be developing (European Commission 2015). These low-income nations include Poland, Bulgaria, Hungary, and Lithuania (European Commission 2015).

Aircraft Emissions

The idea of applying a tax on airlines for their carbon emissions was analyzed by Hofer, Dresner, and Windle in 2010 to see how implementation may work in the U.S. The study noted that an airplane ticket price increase as small as two percent would likely cause customers to divert to using cars as their form of transportation, even for longer distances. The best way to ease emissions that the study suggested was to travel less overall. This study did note that this

would be a difficult change for most Americans. The U.S. is famous for the high numbers of vehicle ownership by its citizens. In a chart that ranked all countries in the world for vehicle ownership per 1000 people, the U.S. ranked third (NationMaster 2014). Emphasis should be made to U.S. citizens to focus their traveling on more efficient modes of transportation such as train or aircraft. The EU ETS was also mentioned in this study and was suggested as a building block for reducing carbon emissions rather than a flat tax rate that was analyzed in this study (Hofer, Dresner, and Windle 2010). For global aircraft emissions, a study suggested that the International Civil Aviation Organization (ICAO) should enact policies on the global scale. These policies could be simple characteristics of the EU ETS, or multifaceted policy that builds off the E.U.'s current policy (Efthymiou and Papatheodorou 2019). The ICAO has stated that a plan to limit the emissions of aircraft globally will begin in 2018 (International Civil Aviation Organization 2017). As of 2021, this policy is now in effect and data on emission numbers is still being collected. However, comprehensive data about airline emission limits are available via the ICAO website.

The updating and streamlining of the efficiency of aircraft parts and accessories are another area that has been explored to assist in lowering emissions. An analysis was conducted on different retrofitting options for airlines' aircrafts to help lower emissions as well as costs associated with fuel burn. The first mentioned retrofit option was blended winglets (see Figure 5). These curved wing tips help lower drag on an aircraft's wings and thus reduce fuel consumption. The study done by Müller, Kieckhäfer, and Spengler in 2018 noted these implementations would save

Blended wingtips (Figure 5)
https://www.businessinsider.com.au/boeing-airplanes-winglets-explain-nasa-2017-7

around $108,000 per year, per aircraft. The next option analyzed was electric taxiing, which focuses on lessening the engine usage for taxiing purposes. An electric motor would be implemented, but these engines would add weight, so they are deemed useful only on short to medium length flights. These were calculated to save around $117,000 per year, per aircraft (Müller, Kieckhäfer, and Spengler 2018). A study was done by Padhra in 2018 on the topic of auxiliary power units (APUs) and ground power units (GPUs) for aircrafts and their contributions to air pollution. This study found that it is normal for the APU to be on after arrival and before departure. The provided solution for this was obtaining accurate departure information. The study also showed that the usage of APUs can be drastically reduced if the aircraft can be given external electricity and pre-conditioned air. The usage of ground power was shown to reduce emissions by 47.6 percent. The one caveat to this is that if the external power is coming from a diesel-fueled GPU, there is a doubling of carbon emissions (Padhra 2018). The last option that was researched was re-engining planes that are currently in service. The new A320Neo engine showed anywhere from 10-15% fuel savings per flight. This type of engine would be implemented into older models such as the A320 and A319. This upgrade would have a steep cost up front of $16.5 million for new engines, but the savings in emissions could be beneficial in the long future of these planes currently in service (Müller, Kieckhäfer, and Spengler 2018).

Airbus vs. Boeing

Airbus and Boeing are the two largest aircraft manufacturers in today's airline market, and they are often referred to as a "duopoly" because these companies combined are the target of 88 percent of market orders from 2016-2035 (Pisarek 2017). Monopolies, or "duopolies" in this case, are sometimes responsible for a lack of competition in a market and can cause a wide array

of less-than-ideal outcomes for consumers (Pisarek 2017). The two outcomes that are of interest in this study are increased prices for goods and slow innovation. Pisarek (2017) compared these two companies to analyze what innovations these manufacturers were pursuing to lessen emissions. The largest operating cost to airlines are aircraft fuel and oil which were found to be responsible for 17.3 to 25.2 percent of the total operating cost (Pisarek 2017). Therefore, lessening fuel usage should be paramount to airlines and subsequently aircraft manufacturers. The lowering of fuel consumption will allow operating costs of aircrafts in general to decrease.

As Pisarek (2017) mentions, oil prices have varied wildly throughout the 21st century so planning accordingly can be difficult. In the early 2010s, oil prices rose dramatically, and this caused both Airbus and Boeing to update their aircrafts to be more efficient (Pisarek 2017). These updates consisted of the growing usage of light, composite materials, new generations of engines, more aerodynamic winglets, additional seats due to reorganization, and construction modifications (Pisarek 2017). Newer models of aircraft from both companies are seeing 45-55 percent lightweight composite makeup. This rate is far higher than 5-30 percent on previous models (Pisarek 2017). Pisarek (2017) stated that "new aircrafts are 70% more fuel efficient than 40 years earlier and 20% better than a decade ago." Airbus has recently come out with a new type of engine for its aircraft called the "NEO" series; these engines use 12-16 percent less fuel, emit 10 percent less CO_2 and nitrogen, and are 50 percent less noise polluting (Pisarek 2017).

Research by Nishant et al. (2018) sought to create sustainability-oriented innovation (SOI). This was defined as, "making intentional changes to an organization's philosophy and values, as well as to its products, processes, or practices, to serve the specific purpose of creating a realizing social and environmental value in addition to economic returns" (Nishant et al. 2018). The aviation sector itself is worth 606 billion dollars; this would make the sector itself rank 21st

in national gross domestic product (Nishant et al. 2018). Gross domestic product is defined as the "total market value of the goods and services produced by a country's economy during a specified period of time" (Bondarenko 2018). As of 2017, the aviation sector is also responsible for two percent of all human-induced CO_2 emissions (Nishant et al. 2018). Boeing is looking to innovate their design to improve both fuel efficiency and the company's carbon footprint (Nishant et al. 2018). Boeing is also partnering with many air traffic control towers to update procedures and increase efficiency in how aircraft are always handled (Nishant et al. 2018). Airbus is also looking into innovation to help reduce their carbon footprint by investing in robotics and other automation technology. This is to increase efficiency as well as reduce the amount of workplace injuries that may occur (Nishant et al. 2018). Airbus is also looking into 3D printing of many different parts of their aircraft to cut waste, production time, and costs (Nishant et al. 2018). Nishant et al. (2018) found that overall, both aircraft manufacturers should be looking to reduce resource consumption and increasing resource efficiency.

Regional Greenhouse Gas Initiative

The Regional Greenhouse Gas Initiative (RGGI) was established in 2005 and was the first mandatory cap and trade program in the United States to limit carbon dioxide from the power sector. The states participating in this policy are Delaware, Maine, Maryland, Massachusetts, New Hampshire, New York, Rhode Island, and Vermont (Center for Climate and Energy Solutions 2018). Each state has seen over three billion dollars in economic benefits from the RGGI since its implementation (Center for Climate and Energy Solutions 2018). Like the EU ETS, the RGGI has seen both success and setbacks when pricing carbon emissions. In the third period of the program (2015-2017), carbon prices were at an all-time high as nuclear plant closures were announced. However, the prices fell dramatically when the Clean Power Act

created by Barack Obama failed. This was solved by providing another cap reduction to increase demand for carbon allowances. The fourth period of the program (2018-2020) saw all the participating states except New Hampshire commit to the Paris Agreement (United Nations and Canada 1992). This agreement states that entities will reduce emission 26-28 percent below 2005 levels by 2025 (Center for Climate and Energy Solutions 2018).

California Cap and Trade Program

The CCTP was launched in 2013 and was the fourth largest in the world at the time. This program was planned to reduce greenhouse gas emissions by more than 16 percent, and then an additional 40 percent by 2030. This program is like the RGGI as the targeted entities are large electric power plants, large industrial plants, and fuel distributors. 85 percent of all California emissions are covered by this program, all of which must comply (Center for Climate and Energy Solutions 2017). The cap decrease is currently at three percent, but meetings are underway to enact a larger decrease after 2021. This program is also unique as now vehicle emissions are being included into a yearly cap. This cost is imposed on the consumer via vehicle emission taxes as well as higher gas prices overall in the state of California (Center for Climate and Energy Solutions 2017).

COVID-19 Impacts on Emissions

COVID-19, which is a version of the coronavirus with similar traits to the SARS and MERS viruses has been responsible for many different regulations being put into place around the world (Centers for Disease Control 2021). Prior to COVID-19, renewable energy production was expanding rapidly. However, this new energy production was deployed alongside fossil fuel energy, with no plan of replacing fossil fuel energy production (Le Quéré et al. 2020). Along

with the new energy production growth, surface transportation emission levels were on a continued rise (Le Quéré et al. 2020). Unfortunately, there are no systems in place to monitor CO_2 levels in real time. Instead, proxy data is available in near-real time or monthly intervals to give an "overall" look at emissions (Le Quéré et al. 2020). The study done by Le Quéré et al. (2020) found an estimated daily fossil fuel CO_2 emission decrease of 11-25 percent of 2006 levels. This data was then normalized with estimated 2019 levels of emissions which equated to a decrease in emissions of 4.2-7.5 percent (Le Quéré et al. 2020). While this figure is small, Le Quéré et al. (2020) noted its significance because this decrease is comparable to levels needed to avoid the 1.5 degree Celsius per year climate warming as detailed in the Paris Climate Agreement (United Nations and Canada 1992).

Le Quéré et al. (2020) mentions that the social changes implemented for COVID-19 are strictly temporary and thus the decrease in emissions is also likely temporary. Some changes that were enacted that Le Quéré et al. (2020) believe will remain in place involve pedestrian transportation such as bicycle and pedestrian lane remodeling. The most important finding from this study was how responsive surface transport emissions can be to policy changes and economic shifts (Le Quéré et al. 2020). This finding is of great use in this study because an emission policy that limits surface transportation emissions is paramount to the decrease in CO_2 emissions in the United States.

METHODS

This study was based on a policy analysis of the EU ETS, the RGGI, and the CCTP, the research evaluated how these policies have succeeded, and how these policies have deviated from their original plan. The geographic area of study were the countries that are included in the E.U. (see Figure 1), the states participating in the RGGI (see Figure 2), and California (see Figure 4). The geographic area that these policies were being implemented in were not highly influential for this study because the sole purpose of these policy analyses was to evaluate how these areas have implemented carbon cap and trade schemes.

Research and analysis began on the EU ETS policy using the EU ETS Handbook for information on the specific rules and expectations it set forth (European Commission 2015). The handbook provided guidelines for entities looking to join the EU ETS, with content such as rules and expected outcomes. This document also provided an entry-level look at what the EU ETS was enforcing and what has worked in both the past and present. When a past failure was mentioned, the solution that was put forward in response usually followed. This was beneficial when analyzing the best features of this policy for nationwide implementation. In some instances, further research was done to analyze more recent events as the handbook was last updated in 2015 (European Commission 2015).

Research for the RGGI was gathered from the Center for Climate and Energy Solutions (Center for Climate and Energy Solutions 2018). This provided a comprehensive background of both the history and status of the RGGI. The same analysis was done on this site as was done for the EU ETS Handbook: the main goal being to find what had worked well, what could benefit from improvements, and what did not work. A timeline was given for this policy that focused on

implementations, changes, and economic activities that occurred. This timeline was used for analysis of the criteria mentioned previously. The research for the California Cap and Trade Program was also based on the Center for Climate and Energy Solutions (Center for Climate and Energy Solutions 2017). This provided a history and summary of what the policy had achieved so far. This information was analyzed and used to help view a more recent implementation of an emissions trading program.

The research done in this study was almost entirely qualitative rather than quantitative in nature. This is because when analyzing policies, while statistics and other figures are useful, there is a greater emphasis on the quality and success of the policies being analyzed. Three steps were created in this study for general policy analysis.

1. Assemble evidence
2. Construct the alternatives
3. Select the criteria

The assembling of evidence consisted of finding emission trading schemes throughout the world. This began with the EU ETS and was followed by the RGGI and the CCTP. Some alternatives to cap-and-trade schemes exist such as flat emission taxes, increased public transportation budgeting, or encouraging more efficient means of transportation such as biking or carpooling. These alternatives were deemed to be less desirable because of the possibility of lacking participation by populations as well as less significant economic benefits. The criteria selected for this study was the likelihood of success if a country-wide emission cap and trade program were to be enacted in the U.S. The next step in the analysis of these emission policies was to gather evidence of their success and shortcomings from as many sources as possible. Careful

selection was done to ensure that this evidence was gathered from sources that were both objective and purely analytical rather than being based in political opinions. While public perception is crucial in the survival of these programs, subjectivity was to be avoided for the scientific nature of this study. The history of these policies was the most useful in deducing how the policies had performed on their goals. Policies with shorter histories, such as the two in the U.S., were harder to analyze historically. Still, evidence was found showing successes and failures of both the RGGI and the CCTP. The final steps in this study were to analyze the successes and failures of these policies and use this knowledge to provide an educated recommendation on future implementation of these emission policies.

RESULTS

The results of the research on the EU ETS can be summarized into three categories: history, economics, and legislation. On the topic of history, the EU ETS stands alone as the first and largest emission trading scheme for reducing GHGs (European Commission 2015). For the sector of aviation, the EU ETS was also the first to implement any sort of cap on emissions. The E.U. did this both to lower emissions, but also to spur the ICAO to investigate implementing a global aircraft emission cap (European Commission 2015). The aviation cap for the EU ETS is 95 percent of what the emissions for aircraft in the E.U. were in 2005 (European Commission 2015). While this statistic is not stringent, this was still the first cap presented for aircraft and thus was likely facing much more scrutiny. Surveys also noted the EU ETS as being one of the first motivators to discuss climate change and climate change policy in board rooms and with management (Laing et al. 2013). These surveys also show that the EU ETS is meeting its short-term goals on topics of emission decreases, investment in greener energy, and awareness but falling behind in successfully reaching long term plans such as being below 2005 level emissions by 2020.

Reformation is another area of the EU ETS that deals in history. One area that was a large target for reformation was the issue of surplus allocations in the E.U. The EU ETS Handbook mentions that the mismatch is attributed to the economic crisis of 2008 and how this could have caused the price of carbon to plunge as the global economy went into a recession. To combat these surpluses, the E.U. decided to delay auctioning of more allocations so that the surplus would naturally diminish over the coming months (European Commission 2015). Another analysis on the EU ETS done in 2013 by Laing et al. found that prior to the economic crisis of 2008, abatement procedures were quite successful. This analysis also found that there is some

legitimacy to the idea that due to the financial crisis, people were working, commuting, and traveling less. This trend could help explain the lack of impact the EU ETS was perceived to have at this time. Rather than a shortcoming of the EU ETS, less emission reduction could be at the fault of the crisis' due to the drastic decrease in active employees and travel (Laing et al. 2013).

Another role that was critical in the creation and monitoring of the EU ETS was the economic impacts of the policy. There were two perceived objectives for the EU ETS and its interaction with the environment. The first objective was to reduce GHG efficiently at a negotiated price and environmental gain (European Commission 2015). The second objective was to promote corporate investment in low-carbon technology (European Commission 2015). As of 2020, 40 billion euros are planned to be invested in the low-carbon economy (European Commission 2020). The second objective is harder than one might perceive because most estimates for reaching low-carbon economies are in the time scales of decades (Laing et al. 2013). This means that there are long-term incentives needed to maintain motivation to continuously pursue a low-carbon economy (Laing et al. 2013). With this shift in economic and energy production focus, there is an increase in production costs for power. This increase in cost can be dealt with in three ways as noted by a policy analysis of the EU ETS by Laing et al (2013). The first method is by absorbing the increased cost. This would mean that power production companies would simply profit less from their power production after taking the increased cost of business into consideration (Laing et al. 2013). The second option would be to decrease the cost of power production by increasing efficiency. This could be done by lowering the number of power plants that use fossil fuels or by increasing the number of renewable energy production plants (Laing et al. 2013). The final option, and least desirable one, would be to pass

the increased cost onto consumers. This choice is least desired for many reasons, the main one being that electricity is something that everyone in the E.U. needs and therefore could cause price gouging. The other concern is that increased cost to consumers would lead to an increased risk of carbon leakage as people would look to save money by seeking out cheaper, "dirtier" means of electricity (Laing et al. 2013).

The yearly income for the EU ETS as of 2015 was $4.64 billion per year based on auctioning of allowances (European Commission 2015). A trading scheme was chosen in the beginning because of the low cost to both participants and the economy of the E.U. The commission decided that a carbon tax would not work because emission levels may not actually be lowered. The E.U. has credited the EU ETS for creating labor jobs and green energy growth. These labor jobs include many different positions that work to construct and maintain renewable energy production (European Commission 2015). The E.U. also claims that having this program stimulates investments in energy efficient measures as well as renewable energy across all countries participating in the EU ETS (European Commission 2015). An issue brought up in the Handbook by the European Commission was the issue of "carbon leakage", which can be summarized as entities seeking areas that are not part of the E.U. to produce energy for them as to not count towards their emissions under the EU ETS (European Commission 2015). Carbon leakage is a significant issue in emission policy because this works to invalidate the entire system by creating more emissions, just elsewhere. This threat is quelled by the E.U. providing more allocations to entities that could be likely to participate in carbon leakage (European Commission 2015). As another study by Laing et al. mentions, leakage in general has been occurring in the E.U. for many years. This is due to labor rates, resource availability, and

legislation. The issue of carbon leakage is complex and requires flexible planning to prevent recurrence (Laing et al. 2013).

The last area that the EU ETS Handbook covered was the idea of legislation and guidelines that are provided to entities in the EU ETS. One aspect that the commission emphasized was that the more countries and entities that participate in the EU ETS, the more global emissions will be reduced (European Commission 2015). In terms of guidelines, the yearly cap decrease for the EU ETS is becoming more stringent than originally proposed – from 1.74 percent to 2.2 percent in 2021 (European Commission 2015). In aviation, the EU ETS affects both E.U. and non-E.U. airlines that operate in the E.U. Any airline that arrives or departs from an E.U. country must meet the emissions standards proposed by the EU ETS (European Commission 2015). The free allocations given to entities in Phase I of the EU ETS were slowly removed in Phase II. Phase III will see the complete elimination of free allocations (Laing et al. 2013). The only free allocations that will be distributed are to those areas that are deemed to be a threat of carbon leakage (Laing et al. 2013).

The RGGI was created in 2005 and was the first mandatory cap and trade program in the U.S. to limit CO_2 from the power sector (Center for Climate and Energy Solutions 2019). This policy shares a lot of similarities with the EU ETS as they were both created around the same time. States participating in the RGGI have seen over $3 billion in economic benefits, with a total revenue coming in around $447 million per year according to the Center for Climate and Energy Solutions in 2019. An area where this policy surpasses the EU ETS is that the yearly cap decrease; where the EU ETS is at 1.74 percent, the RGGI is at 2.5 percent (Center for Climate and Energy Solutions 2019). The price of carbon emissions under this policy jumped exponentially when President Barack Obama proposed the Clean Power Act. This policy would

see the closures of nuclear plants as well as other inefficient power plants across the U.S. (Center for Climate and Energy Solutions 2019). This policy did not pass in the Senate though and thus failed to be implemented. Prices then normalized back to what they had been previously. Many of the states were not content with the failure of the legislation in the Senate and in response, determined that the cap would see a reduction in 2020 (Center for Climate and Energy Solutions 2019). The Cost Containment Reserve was also implemented to prevent prices from rising or falling past a set amount – this is to prevent over-selling or under-selling of carbon emissions (Center for Climate and Energy Solutions 2019). Along with the RGGI, the participating states have agreed to commit to the Paris Agreement to reduce emissions by 26-28 percent below 2005 levels by 2025 (Center for Climate and Energy Solutions 2019). The former U.S. president Donald Trump withdrew the country from the Paris Agreement during his tenure as president; an action that has since been reversed by the new president Joe Biden (Cho 2021). Many countries continued to set emission goals through the Paris Agreement without the U.S. and now Biden must play catch-up (Cho 2021). Biden has already announced legislation plans to invest heavily into green energy and green jobs, stating that the U.S. will have zero emissions from electricity production by 2035 (Cho 2021). This is a bold plan and will require significant work to ensure the goals set forth by Biden can be reached. Nonetheless, the work to decrease emissions in the U.S. seems to be a significant issue to President Biden.

The last policy that was analyzed was the CCTP. This policy was launched in 2013 and is the fourth largest emission policy in the world in terms of entities and emissions covered (Center for Climate and Energy Solutions 2018). This policy covers 85 percent of all emissions in the state of California (Center for Climate and Energy Solutions 2018). Both auctions and trades are the main source of allocation attainment with a focus on auctions for a main source of revenue.

In terms of revenue, California has seen around one billion dollars of revenue per year from this program (Center for Climate and Energy Solutions 2018). The CCTP is much younger in comparison to the two other policies analyzed in this study. With that comes loftier goals such as an overall decrease in GHG emissions by 16 percent between 2013 and 2020, then an additional 40 percent by 2030 (Center for Climate and Energy Solutions 2018). The 16 percent decrease in emissions was met ahead of schedule in 2016, and the policy is on track to reach its goal of a 40 percent decrease by 2030 (Center for Climate and Energy Solutions 2018). The program also has the highest cap declination out of the three analyzed at three percent per year until 2020. The cap declination is set to become more stringent past 2021 but the details have yet to be fully decided on (Center for Climate and Energy Solutions 2018).

POLICY ANALYSIS DISCUSSION

The goal of this study was to analyze the feasibility of implementing a nation-wide emission policy in the U.S. By analyzing the EU ETS, important background was attained to see why the EU ETS was implemented as well as what had worked well over the long history of the policy. The amount of time the EU ETS has been in existence made the policy a great tool to use when interpreting how a similar policy should be created in the U.S. While the U.S. and E.U. are not completely similar, the size of the land covered by the EU ETS can be useful when drafting an idea for the U.S. Many differences exist between the E.U. and the U.S. - both culturally and economically. These differences can act to complicate the analysis and recommendation for future emission policy. However, analyzing the history of the EU ETS allowed the most successful aspects of the policy to be recorded and used as a recommendation for the U.S. An issue that the U.S. should work to avoid is the providing a surplus of allocations in the beginning stages of the policy, as this works to slow the capping of emissions. The U.S. can also investigate how the E.U. boosted investments into green and renewable energy by implementing an emission policy. Finally, carbon leakage is a factor anywhere an emission policy is enacted. The U.S. must be diligent in planning and creating a way to dissuade carbon leakage from occurring.

This study is not meant to be a concrete example of what a U.S. emission policy should contain. Rather, this study is meant to highlight the features (both good and bad) of emission policies to collect as much information as possible. This reason is to make recommendations to entities to implement emission policies as easily and efficiently as possible. While the U.S. was the main area of focus for recommendation of emission policy, many other countries and areas could interpret this research when debating on enacting emission policies. These recommendations for emission policies are as follows: economic needs, current CO_2 emission

rates, and the risk of carbon leakage. Economic needs are important to address because some areas may require more economic stimulation in the form of allocation auctioning, whereas some high-income areas may not need the extra stimulation. Current CO_2 emission rates are important to address where the area is at currently with its emissions and what levels the area has deemed reasonable and desired to reach. This decision can be made by following emission legislation that is currently being followed such as the Paris Agreement (United Nations and Canada 1992). The risk of carbon leakage is strictly addressed by the EU ETS and is important when an area is bordered by another area that could be at risk of outsourcing CO_2 emissions (European Commission 2015).

The issues that the E.U. faced while enacting the EU ETS can serve as great educational experiences now for future policies. The findings from the E.U. about how carbon taxes are not viable can be useful for areas like the U.S. where a simple idea like this may be suggested early on. The issue with carbon taxes is that while economic gains will occur, emissions may not decrease at all. This is because while there is a cost associated with emitting CO_2, wealthy entities could afford the bill to emit as much as they need and then pass the tax onto consumers. However, low-income entities would be adversely affected by this tax, as they could afford far less when emitting. Therefore, the E.U. found that the cap and trade program was the best suited for their economy as the trading of allocations works to provide income for low-income entities while allowing larger entities to emit as they need. All while setting a cap of emissions and working to decrease that cap each year (European Commission 2015). The other main issue that the E.U. faced was the repercussions of providing free allocations to many low-income entities. This was found to have at least partially caused the lull in decreasing emissions in the E.U (Laing et al. 2013). The surplus of allocations was solved by not providing any allocations for two years

but was still a rather large hurdle for the emission policy (European Commission 2015). This raises the question if the U.S. should even provide free allocations if a similar policy is enacted. Free allocations should be used sparingly and with an evident plan to "wean" entities off free allocations as quickly as possible to avoid lags in emission policy progress. The avoiding of free allocations could help the U.S. avoid a stall in decreasing emissions at the cost of impacting low-income entities more than high-income entities (Laing et al. 2013).

CONCLUSION

The goal of this study was to analyze the EU ETS, the RGGI, and the CCTP and obtain information about where these emission programs succeeded, and where there is the need for improvement. This research sought to create suggestions of policy guidelines and goals for a nationwide emission policy for the U.S. to implement. The main purpose behind this study is to analyze the programs mentioned previously and provide suggestions going forward on how to limit and reduce CO_2 emissions in power and possibly aircraft sectors.

The most interesting area of the EU ETS was the inclusion of aircraft emissions into the policy. As mentioned previously, the U.S. is one of the largest sources of aircraft emissions and implementing a cap on these emissions nationwide should be imperative (Center for Biological Diversity 2016). The EU ETS also was forward-thinking with its idea of carbon leakage. Preventing carbon leakage for the U.S. will be significant as Mexico is directly south of the country and could easily produce power at lower costs for U.S. entities. Furthermore, even other states in the U.S. could generate power at lower costs due to possible differences in labor laws and labor costs. A carbon leakage plan should be paramount for a policy in the U.S. to work well and efficiently. The RGGI had a great idea in the Cost Containment Reserve guideline in the policy. This would benefit the U.S. as carbon emission prices are likely to vary much more when an entire country is participating rather than a few states like in the RGGI. The cost containment in the RGGI was credited with being responsible for allowing the most possible money to be made when all allocations are sold (Center for Climate and Energy Solutions 2019). The CCTP had the most stringent yearly cap decrease so this policy should be the front-runner when looking at what cap declination to go with. Regardless of how stringent the cap is, all policies analyzed had a minimum of two percent decrease per year, which should be the minimum target for a

policy in the U.S. This minimum target of two percent each year proved to be successful in each emission policy analyzed. There is a perceived balance to maintain when enacting an emission policy. The CCTP along with the EU ETS proved that emissions policies can work on entities outside of power production. The U.S. should implement an overall emissions cap rather than just a power production emissions cap such as the RGGI.

This study was hindered at times by the lack of policy that was available to the public who may have little to no education in emission policy and data. While these policies are implemented at governmental levels, policies should also come with a civil version to procure the "basic points" so that the policy can be easily understood and analyzed. The only policy with this sort of component was the EU ETS, and even the EU ETS Handbook was built for entities looking to enter the policy and not civilians who wanted to gain knowledge on current policy in their respective country. Citizens may seek to enquire about emission policies because they feel that these policies are lacking justification, need more information, or simply want to know how the policy will affect them in their everyday lives. Another section that would have benefitted from more analysis and data was that of aircraft emission cap data from the EU ETS. With the EU ETS being the first policy to include aircraft, the data from the following years of implementation should be easily accessible to the public. However, data on this topic was difficult to find and was usually done by parties not affiliated with the E.U. Further research into aircraft emission caps would have benefitted this study as to further provide steps and guidelines for a nation-wide inclusion of said emissions. Future research topics could be on the U.S. and its sectors regarding the readiness and ability to participate in a nationwide emissions cap program. Another area for future research would be analyzing current emission policy at state levels to see what states in the U.S. have more generous policies and which states have more stringent

policies. This data can be used to focus on states that need to become stricter on CO_2 emissions. Finally, the last area that could be researched further is the issuing of free or extra allocations by areas implementing an emission policy. In the case of the EU ETS, free allocations were the root cause of a perceived shortcoming of the policy itself because of a massive surplus of allocations in the market. Opposite of the result in the E.U., the CCTP has allowed a cap reserve of free allocations to exist to assist entities into assimilating into a cap-and-trade program. Research could be done on whether that sort of surplus is avoidable when providing free allocations, or if free allocations should be avoided altogether in lieu of a safer alternative.

The success and growing popularity of the RGGI and CCTP in the U.S. are great beginnings for a nation-wide emission policy. The important areas of the U.S. to focus on when proposing a nation-wide emission policy are anywhere in the country that may need more economic assistance when implementing this policy. Just as the E.U. provided extra allocations to areas that may experience more difficulty transitioning to renewable energy production, the U.S. should assist areas in the country that are of similar position (European Commission 2015). This assistance will ensure that the U.S. succeeds at its planned emission policy and setbacks are negated as much as possible.

The recommendation of this study is that the U.S. should work to implement some sort of nation-wide emission policy that is like the EU ETS. The main areas of possible concern when drafting a similar policy to the EU ETS are free or highly discounted allocations, lenient emission caps, and not addressing the issue of carbon leakage. Avoidance of these three issues will be paramount for policy makers and will ensure that the major setbacks experienced by the EU ETS will not be experienced (or at least mitigated) in the U.S. While more issues are sure to arise, eliminating all avoidable scenarios is a step towards efficiency and will set up the nation-

wide emission policy to have the best chance of success. Diligence should be maintained to understand that issues will arise, and that the policy will not be without setbacks. Just as all the policies analyzed in this study had setbacks, the nation-wide policy will as well. However, preparation and flexibility will ensure that the setbacks experienced will be dealt with efficiently and correctly.

As stated earlier in this study, climate change is a crisis for the entire world. Based on the research in this study, an emission policy should be of extreme importance to the U.S. There are many driving factors as to why the U.S. should implement a policy like the EU ETS such as the goals of the IPCC and the dangers of climate change. The U.S. has already seen the impacts of climate change across the country with droughts, severe weather events, and changing ecosystems (NOAA 2019). These warning signs should be motivation enough to lessen emissions, but the opportunity to make lessening emissions an economical benefit should be an even greater source of motivation. The crisis of climate change will not subside and preventative measures to lessen the U.S.'s impact in global CO_2 emissions should be paramount. As the top country in GDP, the U.S. is looked up to by many countries (The World Bank 2019). The creation and implementation of an emission policy will provide motivation to numerous other countries who may view the U.S. as a leader of the world as well as one of the highest CO_2 emitters. Emission policy action by the U.S. will work to fight climate change and lower the risk of significant climate impacts to the Earth as well as human beings.

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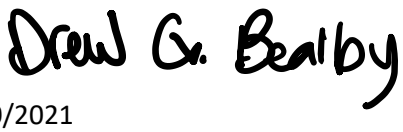
Signature: 

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